International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 8, Issue 4, pp 213-217, April-2024

https://doi.org/10.47001/IRJIET/2024.804030

Plastic Waste Collection from Rivers and Lakes by Robotic System

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***Abstract* - The pollution of rivers and lakes, particularly by plastic waste, has emerged as a critical environmental challenge with profound implications for marine ecosystems. In response, this project endeavors to develop a functional model of a robot specifically designed for the efficient collection of plastic waste from aquatic environments. Leveraging advanced technologies such as computer vision and robotics, the proposed robot aims to revolutionize waste management practices in rivers and lakes, contributing significantly to the preservation of marine ecosystems. Through a combination of technical innovation and unwavering commitment to environmental stewardship, this project seeks to address the pressing issue of plastic pollution in water bodies, offering a beacon of hope in the fight to reclaim our natural havens from the grip of human negligence. The escalating pollution of rivers and lakes by plastic waste has emerged as a global crisis, threatening the health of marine ecosystems and human well-being. This extended abstract outlines a comprehensive project aimed at developing an innovative solution to this pressing environmental challenge. At its core, the project focuses on the design and implementation of a robotic system tailored for the effective collection of plastic waste from water bodies.**

Keywords: Plastic, Waste collection, Rivers, Lakes, Robotic System, Environmental challenge, Plastic wastage, Pollution, Water bodies.

I. INTRODUCTION

The increasing pollution of rivers and lakes, particularly by plastic waste, poses a severe threat to marine ecosystems. This project aims to address this environmental challenge by developing a working model of a robot designed for effective plastic waste collection from rivers and lakes. The robot combines advanced technologies such as computer vision and robotics to collect plastic waste, and contribute to the preservation of marine environments. Rivers and lakes, once the lifelines of civilizations and sanctuaries of biodiversity, have now become choking arteries of plastic pollution.

The serene waters that once nourished communities and supported diverse ecosystems now struggle under the weight of human neglect. Plastic waste, a modern plague, infiltrates these natural havens, disrupting fragile ecosystems and threatening the very balance of life. The gravity of this situation cannot be overstated. As plastic waste accumulates in our water bodies, it not only mars their natural beauty but also endangers countless species that call these waters home. From the tiniest plankton to majestic marine mammals, no organism is immune to the insidious effects of plastic pollution. Microplastics permeate every level of the aquatic food chain, posing a grave risk to human health as well. Yet, amidst this environmental crisis, there exists a glimmer of hope-a beacon of innovation and determination aimed at reclaiming our rivers and lakes from the clutches of plastic pollution.

This project at hand represents a bold step towards this noble cause—a concerted effort to develop a solution that combines cutting-edge technology with a steadfast commitment to environmental stewardship. At its core, this project embodies the spirit of innovation and collaboration essential for addressing the multifaceted challenges of plastic pollution in water bodies. By harnessing the power of computer vision and robotics, the proposed robot represents a paradigm shift in how we approach waste management in aquatic environments. Gone are the days of manual labor and inefficient cleanup efforts; in their place stands a sophisticated machine capable of identifying and removing plastic waste with precision and efficiency.

But beyond its technical prowess, this project symbolizes something far greater—it symbolizes our collective resolve to safeguard our planet for future generations. It serves as a testament to human ingenuity and our capacity to confront even the most daunting of challenges. For in the face of adversity, we refuse to succumb to despair; instead, we choose to confront the problem head-on, armed with nothing but our determination and the belief that a better world is possible. As we embark on this journey to develop a robot for plastic waste collection from rivers and lakes, let us remember the stakes at hand. The fate of our planet hangs in the balance, and it is incumbent upon us to act swiftly and decisively. Together, let us pave the way towards a cleaner, healthier future—one where our rivers run clear and our lakes sparkle with life once more.

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Scope of the Project

We have done has a good future scope in any engineering industry. The main constraint of this device is the high initial cost but has low operating cost and can be adopted anywhere across the country at any time, any conditions for cleaning the gutters.

Our project is simply a drain wastewater cleaner machine, which is automatically operated. Following different modification can be done to improve the output and efficiency.

The device affords plenty of scope for modifications, further improvements & operational efficiency, which should make it commercially available & attractive. If taken up for commercial production and marketed properly, we are sure it will be accepted in the industry. It has plenty of scope if the device is made larger in size.

II. LITERATURE SURVEY

Schmidt, Christian, et al describes the comprehensive review provides insights into the sources and impacts of plastic pollution in rivers, highlighting the urgent need for effective management strategies to mitigate its detrimental effects on aquatic ecosystems and human health.

Kumar, Rajesh, et al noted in their research paper presents the design and implementation of an autonomous robot specifically tailored for collecting plastic waste from rivers. The study discusses the technical aspects, challenges, and potential applications of such robotic systems in environmental cleanup efforts.

Li, Meng, et al stated that, focusing on the technological aspect, this paper explores the use of computer vision algorithms for the automated detection and classification of plastic debris in rivers and lakes. The study evaluates the performance and accuracy of various image processing techniques in identifying and quantifying plastic waste.

Thompson, Richard C., et al revealed about the seminal work provides a comprehensive overview of the environmental impact of plastic pollution in freshwater ecosystems, emphasizing the need for interdisciplinary approaches to address this complex issue. The paper discusses the ecological, social, and economic implications of plastic waste accumulation in rivers and lakes.

Singh, Anirudh, et al stated as this review paper surveys recent advancements in robotics and artificial intelligence technologies for environmental monitoring and cleanup applications.

III. EXISTING SYSTEM ANALYSIS

In recent years, more attention has been paid to water surface environment protection. Current water surface waste cleaning mainly relies on manual operations, which are low-efficiency and dangerous. Traditional methods for floating waste cleaning mainly rely on human operations. However, on one other hand, collecting waste on water surface manually is tough and dangerous due to possibilities of accidental drowning. On other hand, it is low-efficiency to clean up a large water area only relying on human operations and also human work load is high, then aquatic animals were suffered by improper waste collecting mechanism.

Disadvantages

- This inefficiency results in the incomplete removal of pollutants, allowing them to persist and accumulate in the environment.
- Workers are exposed to hazardous conditions, including the potential for accidental drowning, especially in swift-flowing rivers or during adverse weather conditions.

IV. METHODOLOGY OF RESEARCH

The device is place across a river so that only water flows through the lower basement. Floating waste like bottles, plastic cans, covers…. etc. is lifted by lifters which are connected to the chain. The chain revolves with the sprocket wheel which is driven by the motor. The energy provided to the motor is electrical energy. When motor runs the chain starts to circulate making the lifter to lift. The wastage material is lifted by lifter teeth and stored in storage or collecting bin. Once the collecting bin is full, the waste materials are removed from the bin.

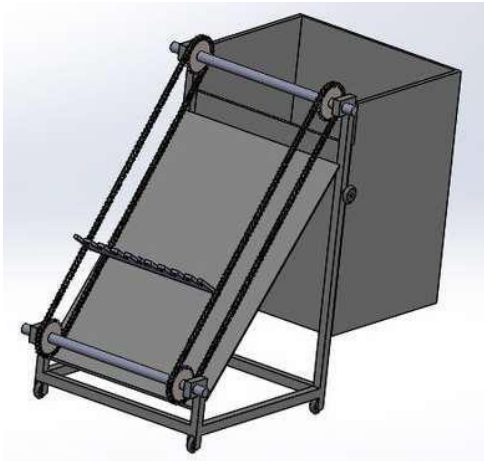

Figure 1: Basic Design of Automatic Scrap Cleaning and Collecting system

If we turn on motor switch or if we supply current to the motor the motor starts to rotate. The rotary motion of the shaft

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is connected to the top shaft by chain and sprockets which is placed on tapper bars. From top shaft that motion is transferred to the bottom shaft by using sprockets and chains. The teeth which are used for lifting waste from drainage is placed or attached between two chains which are on top and bottom shafts. The dust bin which is used for collecting all the waste is attached to vertical bars behind the chains.

V. PROPOSED SYSTEM DESIGN

The floating water extractor used for the removal of waste debris in the water bodies. This machine architecture consists of a cleaner mechanism for the collection and removing waste from water bodies. System consists of mechanism for lifting waste debris from the surface of water bodies. It consists of belt driver mechanism.

Bluetooth Module: Continues to facilitate wireless communication, but with updates to the user interface (via a smartphone app or computer software) to provide a more user-friendly.

User Interface: Development of a comprehensive user interface with intuitive controls, visual feedback, and data visualization capabilities to empower users with greater control and insight into the boat's activities and performance.

Advantages

- Skilled Worker is not required to operate the boat.
- Very less human contact with the water.
- Easy to dispose of the waste.
- Collect more amount of waste in less time.
- Should not harm the aquatic animals.
- It's initial and maintenance cost is low.

Block Diagram

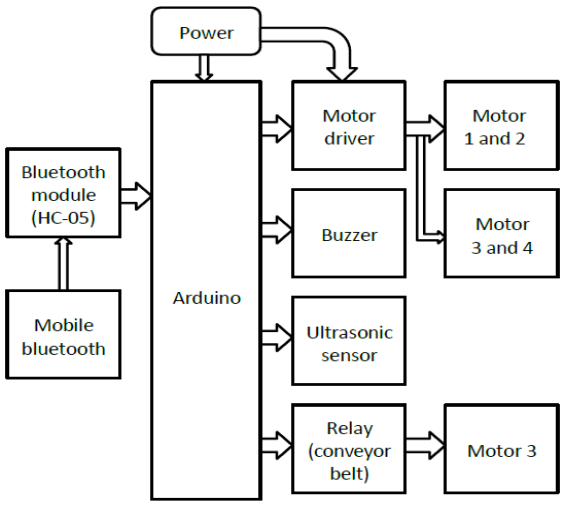

Figure 2: Block diagram of proposed system

Working Principle

In this project the main aim of this machine is to lift the waste debris from the water surface. Here we are fabricating the Bluetooth app operated pool cleaning machine. Separate power supply is given to the 2+2 DC motors 2 at the front for the belt and 2 at the back for the robot to run in the water.

The back 2 motors are connected to the motor driver to control the motors which is further connected to the Arduino dumped with code and Bluetooth module. Next the further working we observe that is by connecting the Bluetooth to an app called jrobot control where all the controls are available from which we can control the robot.

In this studies work the main mission of this equipment is to dispose of the trash from the floor of the water of river and discard them within the tray. Here we are fabricating the river cleansing system which is far away operated. Working Principle In trendy terms, the existing invention relates to a stationary, Solid waste Screening or skimming vessel for gathering waste from flowing waterways by way of the use of 4 exclusive varieties The Fins are connected with rod with the assist of hook at out of doors of the Boat.

The flowing of water from Fins collects the floating stable waste. After collecting stable waste between Fins all the waste is transferred into Last section by way of lifting the fins with the help of Servo Motor. Fins are Hanging from one factor and another point is connected with metal twine and Metal wire is connected with Servo motor. defined herein, with the aid of a solid waste series system for gathering Solid waste in a body of flowing water that has a flotation platform adapted to being securely placed in and floating on the flowing water, a Solid waste series phase set up on the platform having, on one Two rod attached to and lengthening outward from the upstream give up of the platform used to connect the fins with Boat. This segment can be connected with boat the usage of hooks and if these packing containers are full of waste then it is able to be replaced with every other one or else by way of detaching the box this boat can be used for Transportation.

Finally, when the power is on and manually switching on the belt now the belt starts rotating and by using the app controls, we can move the robot in all directions and the belt collects all the dirt and waste.

VI. RESULT ANALYSIS

In this task the primary objective of the machine is to help the waste particles from the water floor and arrange them in the plate. We're manufacturing the Bluetooth worked waterway cleaning electronic device. The gathering arm is

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worked by means of the engine physically utilizing a Bluetooth. The gathering plate is coupled among the 2 hallow PVC channels to gather the waste materials from waterway. The gathered wastages are tossed on the gathering plate with the assistance of mechanical arm. The task is having two fans which are utilized to drive the machine on the stream. The fans keep running with the assistance of two L23D9 engine. The all out electrical gadget is constrained by Bluetooth and joystick which use to control the machine remotely. The remote have changes to control L23D9 engine. We can control the L23D9 by adjusting the Bluetooth. Other two switches are available for moving the arm up & down by working the dc motor.

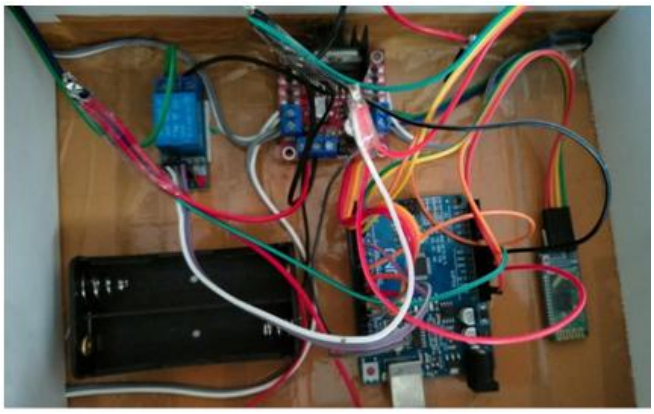

Figure 3: Prototype model with arduino

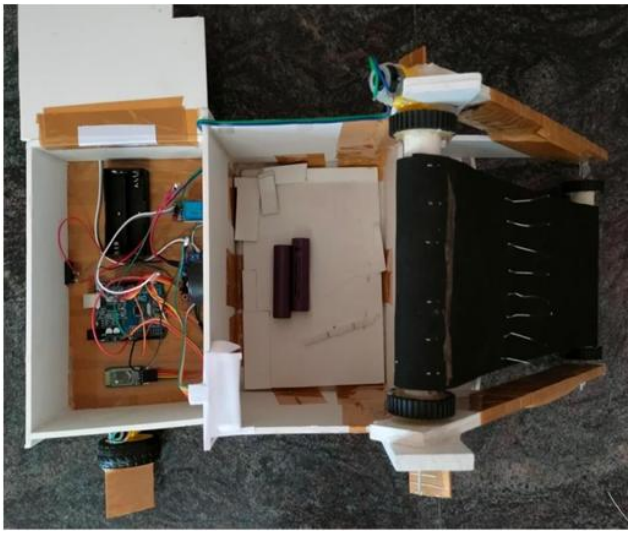

Figure 4: Full prototype model

Advantages

1) Man control is diminished because of robotized self-administration.
2) It is a non-customary river cleaning framework.
3) It's eco-accommodating.
4) Simple in task.
5) Gifted specialists are not required to drive the framework.
6) Its underlying and good condition cost is low. Furthermore, the fundamental preferred standpoint of this is it needn't bother with much human the act of influence with other.

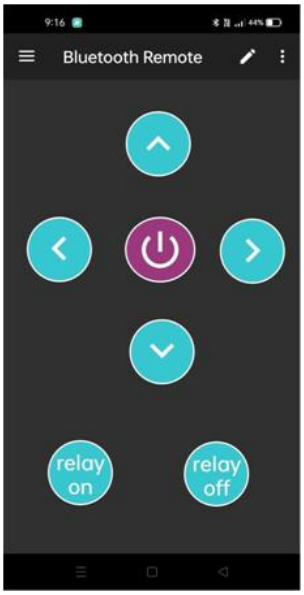

Figure 5: Bluetooth controlled Android App

Applications:

1) It is appropriate to diminish water contamination in streams and lakes.
2) It is valuable to expel the dregs present in pool to keep it clean.

VII. CONCLUSION

In conclusion, the development of a robot specifically designed for plastic waste collection from rivers and lakes represents a significant step towards combating the pervasive pollution threatening our marine ecosystems. By harnessing cutting-edge technologies like computer vision and robotics, this project offers a promising solution to a pressing environmental challenge. Through the implementation of such innovative approaches, we can not only mitigate the adverse effects of plastic pollution on marine life but also contribute to the preservation of biodiversity and the health of our planet. However, it's crucial to recognize that this is just one piece of the puzzle. Efforts to reduce plastic consumption, promote recycling, and implement stringent waste management policies must also be pursued vigorously. Ultimately, by fostering collaboration between technology, science, and environmental stewardship, we can work towards creating a more sustainable future where our rivers and lakes thrive free from the scourge of plastic pollution.

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VIII. FUTURE WORK

The product can be used for plenty other functions in the destiny. It can be changed to throw existence jackets for the duration of rescue operations. This can be finished by fixing suitable propellers with better motor rpms. We can also replace battery with solar panels and make it completely work on solar energy. Technological advancement is one of the important factors, so that it will lead the future of humanity to prosperity and stability. This Water Cleaning mechanism is no one-of-a-kind from this fact as this system can similarly boost technologically. In this device we will use advance conveyor device and conveyor material for increasing the efficiency collection of garbage. We can use the solar panel for providing energy to the boat as opposed to battery operation. To modify the size of boat consistent with its waste collecting potential is increases.

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Citation of this Article:

Rupavathi N, Dhineshkumar A, Manokar G, Vasanthakumar D, "Plastic Waste Collection from Rivers and Lakes by Robotic System", Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 8, Issue 4, pp 213-217, April 2024. Article DOI https://doi.org/10.47001/IRJIET/2024.804030

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